

REMARKS

Reconsideration of this application is respectfully requested in view of the foregoing amendment and the following remarks.

Applicant appreciates the acknowledgement of allowable subject matter in claim 2.

By the foregoing amendment, the title has been amended. Claims 1-28 are currently pending in the application and subject to examination.

Informal Matters

In the Office Action mailed May 18, 2005, the title was objected to for informalities. The title has been amended responsive to the objection. If any additional amendment is necessary to overcome the objection, the Examiner is requested to contact the Applicant's undersigned representative.

Claim Rejections

In the Office Action mailed May 18, 2005, claims 1 and 3-6 were rejected under 35 U.S.C. § 102(b) as being anticipated by U.S. Patent No. 5,210,433 to Ohsawa et al. (hereinafter, "Ohsawa"). Under 35 USC § 103(a), claims 7-16, 19-22, and 27-28 were rejected as being unpatentable over Ohsawa in view of U.S. Patent No. 6,618,087 to Hokari et al. (hereinafter, "Hokari"), claims 17-18 were rejected as being unpatentable over Ohsawa in view of Hokari and further in view of U.S. Patent No. 5,844,290 to Furumiya (hereinafter, "Furumiya"), and claims 23-26 were rejected as being unpatentable over Ohsawa in view of Hokari and further in view of U.S. Patent No. 6,344,666 to Yamaguchi et al. (hereinafter, "Yamaguchi"). Applicant hereby traverses the rejections, as follows.

Claims 1, 3-6, 8, 10, 12, 14, 16, 18, 20, 22, 24, 26 and 28

In rejecting each of claims 1, 3-6, 8, 10, 12, 14, 16, 18, 20, 22, 24, 26 and 28, the Examiner asserts that Ohsawa discloses a solid state image sensor, including a plurality of transducer column groups, each of which is composed of a first photoelectric transducer column wherein a plurality of photoelectric transducers are disposed at given intervals in a given direction, and a second photoelectric transducer column wherein a plurality of photoelectric transducers are disposed at said given intervals in said given direction, the second column being disposed so as to be shifted from the first column by a given amount in said given direction, as recited in independent claims 1 and 8.

Ohsawa discloses a solid state CCD imaging device having a plurality of photodiodes 14 arranged in column and row directions. Photodiodes 14 of a first column of Ohsawa are disposed at a given interval in a column direction, i.e., the vertical direction. Photodiodes 14 of a second column of Ohsawa are similarly disposed at the given interval in the column direction, i.e., the vertical direction. However, Ohsawa does neither disclose nor suggest the second column being disposed so as to be shifted from the first column by a given amount in the given, i.e., the vertical, direction. Rather, as shown in Fig. 1, the first and second columns of Ohsawa are disposed such that there is no "shift" between positions of the photodiodes of the second column with respect to those of the first column in the vertical direction. The same holds true if the column direction is taken to be the horizontal direction.

As seen in Fig. 12A of the present application, which shows a conventional square lattice type arrangement, three electrodes 102a, 102b and 102c are disposed between two pixels adjacent to each other in a vertical direction (upper and lower pixels that are adjacent to each other). Accordingly, in general, a three layer structure of electrodes is employed, as seen in the conventional examples shown in Figs. 12A, 12B and 12C of the present application.

However, if one wishes to employ a single layer structure of electrodes for decreasing the step height of the structure, plural electrodes must be disposed in a space between the upper and lower pixels as seen in Fig. 1 of cited reference Ohsawa. But, as a result, the element separating spaces of a single layer structure must be designed wider than in a three electrodes structure. In addition, these spaces correspond to an isolation region which cannot be used for either transferring electric charges or receiving light ("unusable region"). Accordingly, such a wider design consumes more area for disposing the light receiving portions.

In contrast, in the honeycomb arrangement of the present invention, as seen in Fig. 2 of the present application, plural electrodes 34 can be disposed only on the charge transferring channel regions ("diffusion regions") 20 since pixel columns are disposed so as to be shifted toward each other by a predetermined distance. Thus, the aforementioned unusable regions do not exist in the present invention. In other words, wasteful consumption of area for the disposing of the light receiving portions does not occur.

As explained above, Ohsawa neither discloses nor suggests a solid state image sensor, including a plurality of transducer column groups, each of which is composed of a first photoelectric transducer column wherein a plurality of photoelectric transducers are disposed at given intervals in a given direction, and a second photoelectric transducer column wherein a plurality of photoelectric transducers are disposed at said given intervals in said given direction, the second column being disposed so as to be shifted from the first column by a given amount in said given direction, as recited in independent claims 1 and 8.

Moreover, none of Hokari, Furumiya, and Yamaguchi, alone or in combination, discloses or suggests the second column being disposed so as to be shifted from the first column by a given amount in said given direction, as recited in independent claims 1 and 8. Therefore, none of the cited art of record discloses or suggests each and every feature recited in independent claims 1 and 8.

Since claims 2-6 depend from claim 1 and claims 10, 12, 14, 16, 18, 20, 22, 24, 26 and 28 depend from claim 8, these claims are allowable for the same reasons as claims 1 and 8, as well as for the additional subject matter recited therein.

Claims 7-28

Regarding the rejection of independent claim 7 as being unpatentable over Ohsawa in view of Hokari, the Examiner asserts that Ohsawa teaches all of the features of claim 7 with the exception of a nonconductive light-shielding film formed above the monolayer electrodes and having light-transmitting portions

through which light received in light-receiving areas of the photoelectric transducers is transmitted, as recited in independent claim 7. It should be noted that the monolayer electrodes of claim 7 pass between the photoelectric transducers and extend in a direction that intersects the given direction, for transferring charges from the photoelectric transducers.

The Examiner asserts that Hakori teaches a nonconductive light shielding film 20 formed over the "monolayer electrodes," and that it would have been obvious to use the nonconductive light shielding film 20 of Hakori in the CCD image sensor of Ohsawa because Hakori teaches that the use of a nonconductive light shielding film formed above the monolayer electrodes reduces the capacitance between the electrode layer and the light shielding film.

Hakori discloses a first light shielding film 110 formed over an image region 81 including electrodes 108 of vertical CCD registers 83, which are disposed along columns of photo-diodes 82 for transferring charges therefrom. The first light shielding film 110 has opening portions 91 corresponding to the photo-diodes 82. Hakori also discloses a second light shielding film 20, different from the first light shielding film 110, formed over the horizontal CCD register 85 and electrodes 108' thereof. Hakori explicitly discloses that the first light shielding film 110, which is formed above the vertical charge transfer electrodes and has openings therein for the photo-diodes 82, is made of metal or metal silicide. Hakori discloses that the second light shielding film 20, which is formed over the horizontal CCD and is not formed in the image region, is made of a resin. Hakori does not disclose or suggest forming the second (resin) light

shielding film 20 over the electrodes of the vertical CCD registers, or to have openings therein for the photodiodes. Thus, combining the second (resin) light shielding film 20 as taught by Hakori with the CCD image sensor of Ohsawa would not yield a nonconductive light-shielding film formed above the monolayer electrodes and having light-transmitting portions through which light received in light-receiving areas of the photoelectric transducers is transmitted, as recited in independent claim 7.

Moreover, the Applicant submits that there is no motivation to combine the references as suggested by the Examiner.

Ohsawa discloses first, second, and/or third "gap potential control electrodes" 30, 32 and/or 34 as light shielding layers of the CCD image sensor. First gap potential control electrode 30 is disposed above the vertical transfer control electrodes 20 except for a formation region of the pixel photodiodes 14. The first gap potential control electrode 30 receives a control signal to adjust the potential in a gap G_v between the vertical transfer control electrodes 20 to facilitate efficient charge transfer. The second gap potential control electrode 32 is disposed above the horizontal transfer control electrodes 24 and receives a control signal to adjust the potential in a gap G_h between the horizontal transfer control electrodes 24 to facilitate efficient charge transfer.

Ohsawa discloses "a problem of degradation in transfer efficiency...can be significantly solved by only adding the gap potential control electrodes 30, 32, and/or 34 **without complicatedly modifying the basic structure of the CCD image sensor.**" See Ohsawa at col. lines (emphasis added.)

Thus, replacing any of the first, second and third gap potential control electrodes 30, 32 and 34, which act as conductive light shielding layers in the CCD image sensor of Ohsawa, with the nonconductive light shielding layer 20 of Hakori, would 1) render the CCD image sensor of Ohsawa unsatisfactory for its intended purpose, 2) change the basic principle under which the CCD image sensor of Ohsawa was designed to operate, and 3) require a substantial reconstruction and redesign of the elements shown in the CCD image sensor of Ohsawa. Section 2143.01 of the MPEP states that any one of these three outcomes resulting from the proposed modification is sufficient to conclude that there is no motivation or suggestion to make the proposed modification. Accordingly, it is respectfully submitted that the combination of Ohsawa and Hakori, as suggested by the Examiner, and any rejections based thereon, is improper. As such, withdrawal of the rejections of claims 7-28 under 35 USC § 103(a) as being unpatentable over the combination of Ohsawa and Hokari is respectfully requested.

For all of the above reasons, the Applicant traverses the rejections of claims 7-28.

Conclusion

For all of the above reasons, it is respectfully submitted that claims 1-28 are in condition for allowance and a Notice of Allowability is earnestly solicited.

Should the Examiner determine that any further action is necessary to place this application into better form, the Examiner is invited to contact the undersigned representative at the telephone number listed below.

In the event this paper is not considered to be timely filed, the Applicant hereby petitions for an appropriate extension of time. The fee for this extension may be charged to our Deposit Account No. 01-2300 referencing client matter number 108235-00001. The Commissioner is hereby authorized to charge any fee deficiency or credit any overpayment associated with this communication to Deposit Account No. 01-2300 referencing client matter number 108235-00001.

Respectfully submitted,

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Enclosure: Petition for Extension of Time